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SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

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PLEASE NOTE

This report presents unevaluated information on Soviet Bloc International Geophysical Year activities selected from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

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I. GENERAL

Kazakhstan Meteorologists in IGY

Operations in Kazakhstan in the framework of the IGY program are conducted by 45 hydrometeorological and specialized observation stations.

Actinometric observations in Kazakhstan for international exchange are conducted in Semipalatinsk. Observations are made for direct and scattered solar radiation, reflected radiation, and radiation and heat balance of the underlying surface. Material on heat balance and radiation are of special interest from the viewpoint of the study of the climate of a territory and the general circulation of the atmosphere.

Observations for noctilucent clouds are conducted at 21 Kazakhstan stations.

Visual observations for aurorae are carried out at 41 stations. To these are added the observations made by airline crews. The study of aurorae will give certain information on the density and composition of the atmosphere at altitudes of about 1,000 kilometers.

Investigations of atmospheric ozone are extremely important to the IGY program for studying the meteorological pattern at high altitudes. These observations are conducted with the aid of the three-channel photoelectric ozonograph, OFET-3, which was developed in the Soviet Union. The instrument is designed to register the direct ultraviolet radiation of the Sun using three selective light filters. Such measurements will make it possible to determine the over-all ozone content and by means of calculations to give its vertical distribution. The Alma-Ata ozonometric station has already conducted about 3,000 observations under the IGY program.

Aerological observations which must shed some light on the condition of the free atmosphere, the pressure, temperature, the moisture content of the air, and the wind direction and velocity up to an altitude of 25 kilometers are conducted. These observations will give extremely valuable material for studying wide-scale atmospheric processes and, for the first time, the general circulation of the atmosphere.

The territory of Kazakhstan is characteristic for studying the continental climate of the northern hemisphere and also for explaining the influence of hydrodynamic conditions of the Tien-Shan mountain chain on the general circulation of the atmosphere. For this reason, the conduct of the IGY in Kazakhstan was connected with the construction and organization of large, new radar-equipped aerological stations.

Seven Kazakhstan stations are engaged in aerological observations. These are at Alma-Ata, Aktyubinsk, Balkhash, Karaganda, Kustanay, Gur'yev, and Semipalatinsk.

The existing world aerological network, supplemented during the IGY, will make it possible to obtain data for studying atmospheric circulation at great altitudes, to follow the exchange of air masses between the northern and southern hemispheres and many other phenomena and processes, essential for the solution of weather forecasting problems.

Workers of the Kazakhstan hydrometeorological service are making a considerable contribution to the IGY program. ("Kazakhstan's Meteorologists -- Participants in the IGY," by I. Porfir'yev, Chief of the Administration of the Hydrometeorological Service, Kazakhstan SSR, and V. Nikitin, Senior Engineer-Aerologist; Kazakhstanskaya Pravda, 10 Oct 58, p 3)

New Soviet Instrument for Measuring Heat Flows in Various Media

A new instrument for determining the thermal flows in ice and snow cover, in soils, and also in the bottom of water basins is described in a Soviet scientific periodical.

The calorimeter consists of 1,000 series-connected copper-constantan thermocouples, threaded back and forth uniformly through a 250 by 200 by 30 millimeter plexiglass plate so that all even numbered and all odd numbered thermocouples are on opposite surfaces. The thermocouples rest in recesses on the upper and lower surfaces so that the distance between the odd and even numbered thermocouples is 25 millimeters. A solution of plexiglass and dichloroethane poured over both surfaces effectively fills all openings and covers both surfaces, protecting the thermocouples and wiring from water. This covering also is a good conductor of possible thermal changes, as both the calorimeter and coating have become monolithic. A lead connects the calorimeter with a galvanometer. With a drop in temperature on the surfaces of the plate a difference in potentials arises at the ends of the calorimeter. This is caused by the differences in the temperature of the layers touching the upper and lower surfaces of the instrument.

Both individual measurements as well as continuous recordings of thermal flows in snow and ice covers, in soil and the bottom of water basins made with the aid of this calorimeter show that the proposed method is very accurate, is simple and has the advantage of making it possible to investigate the course of heat processes exchange directly and under natural conditions without the need of taking samples of the medium. ("Instrument for Determining Heat Flows," by A. G. Kolesnikov and A. A. Speranskaya, Moscow State University imeni M. V. Lomonosov; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 11, Nov 58, pp 1351-1359)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Mystery Signals Picked up By Swedish Radio Station

Signals identical to those transmitted by the Soviet sputniks were picked up on 9 December by a Swedish amateur radio operator. The Enkoeping radio control station near Stockholm, which since 9 December has been following the signals broadcast on 32.6, 31.0 and 97.1 megacycles, announced on 10 December that at the moment it is impossible to tell if these signals are being broadcast by a new satellite. ("Some Mysterious Radio Signals"; Brussels, La Libre Belgique, 12 Dec 58, p 5)

First Polish Experimental Rocket Launched

Scientists of the Polish People's Republic devote considerable attention to work in creating rockets for meteorological and other research in the upper layers of the atmosphere. Recently the Polish press reported the successful launching of a two-stage rocket in Bledowska Pustynia which was built by the Krakow Division of the Polish Society of Astronauts and the Rocket Section of the Mining and Metallurgical Academy in Krakow.

The rocket was 820 millimeters in length, 63 millimeters in diameter, and weighed 4.35 kilograms. Its one kilogram of solid fuel produced a working pressure of 40 kilograms per square centimeter and a thrust of 100 kilograms.

The rocket was launched from a device 3 meters long inclined at an angle of 80 degrees. At the moment of launching the rocket was tracked by means of theodolites located at three points.

At present, Polish scientists are engaged in developing a plan for building and testing the first stage of a meteorological rocket. ("Polish Scientist's First Experimental Rocket"; Moscow, Sovetskaya Aviatsiya, 13 Nov 58, p 4)

Czech Determines Oblateness of Earth Based on Motion of Orbital Node of Sputnik II

The positions of the ascending node of the orbit of Sputnik II were determined on the basis of 47 (mainly visual) observations made during the period from 5 November 1957 to 21 March 1958 at various places in Czechoslovakia. The equations used in this determination are given. The mean quadratic error of one determination of the position is 0.19 degrees. The nodal line shifted 360 degrees during the observations. An evaluation of observations for the instantaneous velocity of the motion of the ascending node gave an expression for the relationship of the daily motion of the node to time.

The theoretical value of the velocity of the motion of the node was obtained from the Lagrange equation for the variation of constants. In the expansion of the perturbing function, consideration was given to the term containing the Legendre polynomial of the 4th order and the term containing the fourth order of the eccentricity of the orbit. In calculating the nodal motion attention was also paid to the radial component of the disturbing force. From the motion of the node determined on the basis of the observations and using auxilliary quantities determined elsewhere, the difference in the moment of inertia of the Earth was calculated for 8 moments in the whole period of observation and these were shown to be in good agreement with results obtained by others from perturbations of lunar motion. The mean relative error in this determination was 0.0012 of the total value. The oblateness of the Earth was calculated from the difference in the moments of inertia to be

$$\alpha = \frac{1}{297.90 \pm 0.18}$$

It is claimed that artificial satellites are more suitable for studying the Earth's field of gravity than the distant Moon. More accurate methods of observation, i. e., photographic, must be used in order to obtain a more exact value of the oblateness of the Earth. ("The Motion of the Orbital Node of Sputnik II (1957 β) and the Oblateness of the Earth," by Emil Buchar, Astronomical Institute, Czech Technical University, Prague; Prague, Studia Geophysica et Geodetica, No 4, 1958, pp 306-321)

Space Flight Studies In USSR Discussed

It has only recently become evident how close to reality is the dream of space travel by man. Scientific and technical knowledge has increased considerably. However, before a man can be sent into outer space by rocket, greater research effort will be necessary. Science must yet solve many complicated problems. The most important of these is the crew's safe return to Earth.

Many questions, including that of re-entry, are being investigated under laboratory conditions. But not everything connected with flight into outer space can be studied under laboratory conditions. So Soviet scientists are also conducting biological studies outside laboratories: animals have been sent up to altitudes of 100-200 kilometers. Some animals have been sent up to altitudes as high as 450 kilometers above the surface of the Earth.

The second Soviet artificial earth satellite must be mentioned in that connection, because it had for its passenger the dog Layka.

A visit to the laboratories of an institute where four-legged "space travellers" are being trained for flights into the upper layers of the atmosphere is described by A. Galkin, Candidate of Medical Sciences. Here he saw special hermetic cabins which simulate conditions of flights in high-altitude rockets. The hermetic cabins contain instruments that work automatically, registering the reactions of living organisms during their flights into "space". Special moving picture cameras record the behavior of the animals in flight. Galkin says that he saw two dogs in one hermetic cabin. These dogs have already been sent up to an altitude of 200 kilometers. ("Road to the Stars," by A. Galkin, Candidate of Medical Sciences; Moscow, Krasnaya Zvezda, 25 Nov 58, p 3)

II. UPPER ATMOSPHERE

Sodium Luminescence in Atmosphere Subject of Czech Study

The intensity of perturbing radiation with a wave length of 5,893 Å enters in all possible theories on the twilight luminescence of the sodium layer of the atmosphere as an essential factor. Up to now these values were only approximately calculated.

A complete theory for the luminescence of the high layers of the atmosphere is presented and is applied to the above stated problem. Values of the intensity of luminescence are presented in table form. A comparison with earlier obtained results confirms the usefulness of the new tables. ("Twilight Luminescence in Yellow Light 5,893 Å," by Frantisek Link, Astronomic Institute Czechoslovak Academy of Sciences, Prague; Prague, Studia Geophysica et Geodaetica, No 1, 1958, pp 47-53)

IV. OCEANOGRAPHY

Vityaz' in Vancouver

The Vityaz', expeditionary ship of the Institute of Oceanology Academy of Sciences USSR, is reported in Vancouver, Canada, after 5 weeks of operations in the North Pacific Ocean.

Members of the expedition and the ship's crew visited the city and its scientific institutions.

Dr Richard Fleming, American oceanographer, was among the many visitors received by N. N. Syscyev, Candidate of Technical Sciences, chief of the Vityaz' expedition, on board the ship. (Moscow, Sovetskiy Flot, 30 Nov 58, p 4)

Submarines to Supplement Soviet Oceanographic Studies

Complex oceanographic investigations is various regions of the World oceans were begun by scientific institutions of the Academy of Sciences USSR in connection with the conduct of the IGY.

Submarines will take part jointly with surface ships in these operations. Experimental work both in the USSR and abroad has shown that the use of submarines will make it possible to obtain extremely valuable scientific data which other type ships cannot gather.

As previously reported (Soviet Bloc IGY Report No 44, 12 Dec 58), in the very near future a specially outfitted submarine will be used for the above-mentioned scientific investigations by the All Union Scientific Research Institute of the Fish Economy and Oceanography (VNIRO).

Investigations in the oceans, including those of the southern hemisphere, will be continued in the coming year. ("Scientific Investigations in Different Regions of the World Oceans"; Moscow, Pravda, 9 Dec 58, p 6)

Soviet Research in Baltic

The Soviet research ship Okeanograf is reported to have put into the port of Leningrad after a 1 1/2 month voyage in the Baltic Sea. Another ship of the research fleet, the Professor Rudovits, arrived in the port two days earlier completing its 19th voyage in the Baltic.

Oceanographers on board these ships are supplied by the Leningrad Division of the Institute of Oceanology, Academy of Sciences USSR. Extensive research work is conducted in the northern, southern and central parts of the Baltic Sea under the IGY program. ("According to the Program of the IGY"; Vil'nyus, Sovetskaya Litva, 26 Sep 58, p 1)

V. ARCTIC AND ANTARCTIC

USSR Gives Poland Base in Antarctic

Thanks to a generous gift from the Soviet Union, the Polish flag will fly in the Antarctic. The USSR government has just officially transferred the station Oazis to the Polish government. Located 360 kilometers from the Mirnyy base, the Oazis base is in a region surrounded by huge glaciers. The Polish scientists will conduct observations and scientific research with the material left by the Soviets. This work will include meteorology, seismology, and the study of terrestrial magnetism. The Polish group will take over the base before the end of 1958. ("USSR Gives Poland 'Oazis' Base in Antarctic;" Paris, L'Fumanite, 9 Dec 58)

The first group of Polish scientists will depart for Antarctica this year aboard the Soviet ship Mikhail Kalinin. The ship will put in to the port of Gdynia for this purpose ("Transfer of Soviet Antarctic Station to Poland"; Moscow, Pravda, 9 Dec 58)

Activities at Station Vostok

The station Vostok at the south geomagnetic pole has been in operation for the past 10 months. The entire program of research activities conducted at the station has produced data of great scientific and practical interest. The complex series of research conducted by O. Kolomiytsev and P. Maysuradze in geomagnetism, ionosphere, and auroras, has made it possible to determine a relation between the magnetic storms and auroras in the station area. The vertical sounding of the ionosphere is done with the help of a modern automatic ionosonde, and auroras are photographed with a special camera which is able to take picture of the whole firmament. The program of observations in meteorology, actinometry, aerology, and glaciology, is being carried out successfully.

Although the station Vostok is not large, it is equipped with modern instruments. It has a remote-control meteorological station, an apparatus for registering the temperature and humidity of the air and the wind velocity. The height and density of the snow cover are determined on a special area covering 1,300 square meters. Self-recording devices continuously register the meteorological elements and all types of solar radiation.

There are 11 scientists, most of them young people, conducting research at the station Vostok.

During the polar night, the air temperature dropped to less than minus 87 degrees Centigrade. In such weather a few seconds are sufficient to get one's face or hands frozen if they are not protected. The scientists are equipped with special clothing. However, when the temperature drops to below minus 80 degrees Centigrade, the men are not allowed to stay outside for more than 15 minutes, and at a temperature below minus 85 degrees Centigrade -- only up to 10 minutes. During the severe frost the men were not allowed to go out singly even for a short period.

The equipment also suffered under the cold. Instruments froze at temperatures below minus 60 degrees Centigrade. Much effort and resourcefulness was required in order to adapt the technical equipment to operating under low temperatures. Various improvements made by the scientists helped to solve this difficult problem. The polar night brought with it many mishaps. The storm wind wrecked the aerological pavilion, and the only solution was to build a new one. This was an extremely difficult task at minus 75 degrees Centigrade and in complete darkness. The work under these conditions continued for 3 weeks, with the help of searchlights, until the construction job was completed. Now the production of hydrogen and the filling of radiosonde balloons is done in a subsnow pavilion at a depth of 5 meters.

During the heavy frost, much effort was spent in supplying fuel to the diesel engines of the electric power station. The fuel froze and had to be heated for long periods before pouring. When the temperature dropped to minus 87 degrees Centigrade, the high-pressure generators went out of order. A special low-pressure installation for obtaining hydrogen had to be built.

The station Vostok is situated at an elevation of 3,420 meters. As a result of low atmospheric pressure, the boiling point of water is 83 degrees Centigrade. This presents many problems in the preparation of food.

The polar night lasted for more than 4 months. Now that it is over, the sun shines almost 24 hours a day. The temperature is minus 60 degrees Centigrade. The station staff can endure such temperatures quite easily, as they are hardened by experience and training. The snow drifts have been removed, and the equipment and instruments have been repaired.

On 1 October, the first plane arrived from Mirnyy and dropped food and other freight by parachute over Sovetskaya and Vostok. ("Temperature—Minus 87 Degrees," by V. Sidorov, chief of Station Vostok; Moscow, Sovetskaya Rossiya, 8 Oct 58)

Geological Research in Antarctica

Antarctica is the only continent on the earth which is almost completely covered with ice. The antarctic ice sheet reaches a thickness of 3,000 meters. However, over 600,000 square kilometers of the area consist of ice-free mountain ranges, as well as rocky "oases" located along the edges of the continent in the region of the shelf ice.

Before the beginning of the IGY research program, geological research routes had covered only 5 percent of the antarctic mountains. However, information on the geology of Antarctica is important for solving a number of theoretical problems concerning the structure of the Earth's crust and of historical geology, and for compiling a single geological map of the Earth.

Soviet scientists started geological research in East Antarctica only during the past 3 years. During this period, a group of associates of the Scientific Research Institute of Geology of the Arctic visited 36 points on the coast of East Antarctica, covering almost 6,000 kilometers between 57 and 165 degrees E longitude. A geological survey was made in the area of Mirnyy, Bunger Oasis, and the Obruchev Hills. Many ice-free outcrops of basic rocks were investigated between 80 and 110 degrees E longitude. In other places, only isolated rocks rising above the ice near the coast were inspected. Airplanes and helicopters transported the scientists to the foot of the rocky mountains and into the almost inaccessible parts of the rocky "oases" surrounded by sea fiords or by huge crevasses in the shelf ice.

Interesting geological discoveries have been made. One of the oldest layers of crystalline schist on the Earth, which is over 15 kilometers thick, was studied. In addition to the usual gneiss rocks, there were large seams of marble and quartzites. Among the crystalline schists were massifs of granitoids of the Indian charnockite and the Finnish rapakivi types. These were connected with pegmatite veins containing mica and rich veins of iron ore. Under the influence of the glacier movement, accumulations of boulders had formed around the mountains and "oases." Fragments of magnetite quartzites and schists were frequently found in those areas, proving the existence of iron ore beneath the ice cap.

It has been possible to ascertain a number of important natural laws in the geological structure of Antarctica. A fundamentally new discovery in this respect is the three-level structure of the East Antarctic platform instead of the two-level structure, as had been assumed previously.

It was discovered that the present outlines of the coast of East Antarctica are determined by large zones of breaks, along which a large part of the East Antarctic platform is now settled on the bottom of the Atlantic and Indian Oceans. At the same time, block-shaped mountains were formed along the periphery of the continent, which were also caused by two systems of recent breaks. Volcanoes frequently appeared at the intersections of these breaks. One of them, Gaussberg, which is located 180 kilometers west of Mirnyy, was active until fairly recently.

Interesting observations have been made regarding the position of the sea terraces along the coast and regarding the glacier hachure, which has preserved a record of the glacier movement at different times. This made it possible to determine several phases of glaciation in Antarctica. In the interval between these phases, a considerable warming of the climate took place and the size of the glacial cover was considerably reduced.

In general, the study of the geological structure of the East Antarctic platform is still in its initial stage. The scientists of a number of countries studying the glacial continent are faced with the task of active participation in a planned geological survey of the ice-free areas.

In 1959, the Soviet geologists of the Fourth Antarctic Expedition plan to make a study of the block-shaped mountains on Queen Maud Land, where one of the largest mountain systems of Antarctica is located. ("Explorations of Mountain Ranges," by Prof M. Ravich; Moscow, Vodnyy Transport, 25 Nov 58)

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